IMMUNO BIOLOGY

THE IMMUNE SYSTEM IN HEALTH AND DISEASE

FOURTH EDITION

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CURRENT BIOLOGY PUBLICATIONS

GARLAND PUBLISHING
Taylor & Francis Group

EXHIBIT
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PAGE 11/14 * RCVD AT 6/20/2005 9:19:47 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-1/0 * DNIS:8729306 * CSID:608 258 7138 * DURATION (mm-ss):04-14

Text Editors: Penelope Austin, Eleanor Lawrence
Editorial Assistant: Richard Woof
Copyeditor: Bruce Goatly
Production Editor: Emma Hunt
Indexer: Liza Weinkove
Illustration and Layout: Blink Studio, London

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Distributors:

Inside North America: Garland Publishing, 19 Union Square West, New York, NY 10003, US.
Inside Japan: Nankodo Co. Ltd., 42-6, Hongo 3-Chome, Bunkyo-ku, Tokyo 113, Japan.
Outside North America and Japan: Churchill Livingstone, Robert Stevenson House, 1–3 Baxter's Place, Leith Walk, Edinburgh, EH1 3AF.

ISBN 0 8153 3217 3 (paperback) Garland
ISBN 0 4430 6275 7 (paperback) Churchill Livingstone
ISBN 0 4430 6274 9 (paperback) International Student Edition

A catalog record for this book is available from the British Library.

Library of Congress Cataloging-In-Publication Data
Janeway, Charles.
Immunobiology: the immune system in health and disease / Charles A. Janeway, Jr., Paul Travers, Mark Walport; with the assistance of J. Donald Capra.—4th ed.
p.cm.
ISBN 0-8153-3217-3 (pbk.)
1. Immunity.I. Travers, Paul, 1956–II. Walport, Mark.
III. Title.
QR181.J37 1999
616.07'9- - dc21

98-30316
CIP

This book was produced using QuarkXpress 3.32 and Adobe Illustrator 7.0.

Printed in United States of America.

Published by Current Biology Publications, part of Elsevier Science London
Middlesex House, 34–42 Cleveland Street, London W1P 6LB, UK
and Garland Publishing, a member of the Taylor & Francis Group,
19 Union Square West, New York, NY 10003, US.

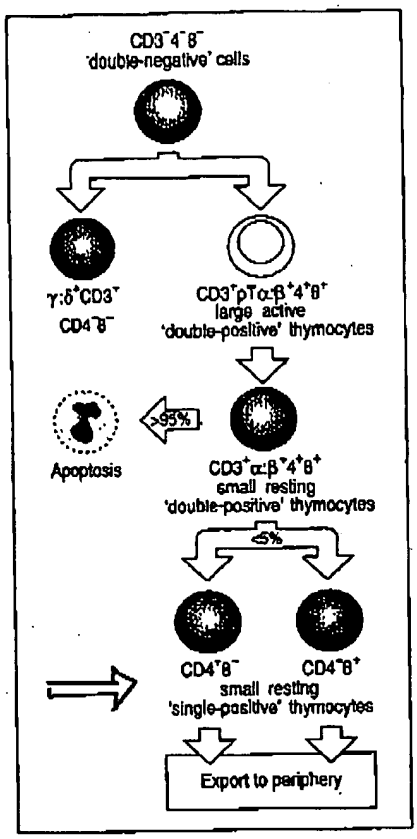


Fig. 7.6 Changes in cell-surface molecules allow thymocyte populations at different stages of maturation to be distinguished. The most important cell-surface molecules for identifying thymocyte subpopulations have been CD4, CD8, and T-cell receptor complex molecules (CD3, and α and β chains). The earliest cell population in the thymus does not express any of these. As these cells do not express CD4 or CD8, they are called 'double-negative' thymocytes. (The γ:δ T cells found in the thymus also lack CD4 or CD8 but these are a minor population.) Maturation of α:β T cells occurs through stages where both CD4 and CD8 are expressed by the same cell, along with the pre-T-cell receptor (pTα:β) and later low levels of the T-cell receptor (α:β) itself. These cells are known as 'double-positive' thymocytes. Most thymocytes (~97%) die within the thymus after becoming small double-positive cells. Those whose receptors bind self MHC molecules lose expression of either CD4 or CD8 and increase the level of expression of the T-cell receptor. The outcome of this process is the 'single-positive' thymocytes, which, after maturation, are exported from the thymus as mature single-positive T cells.

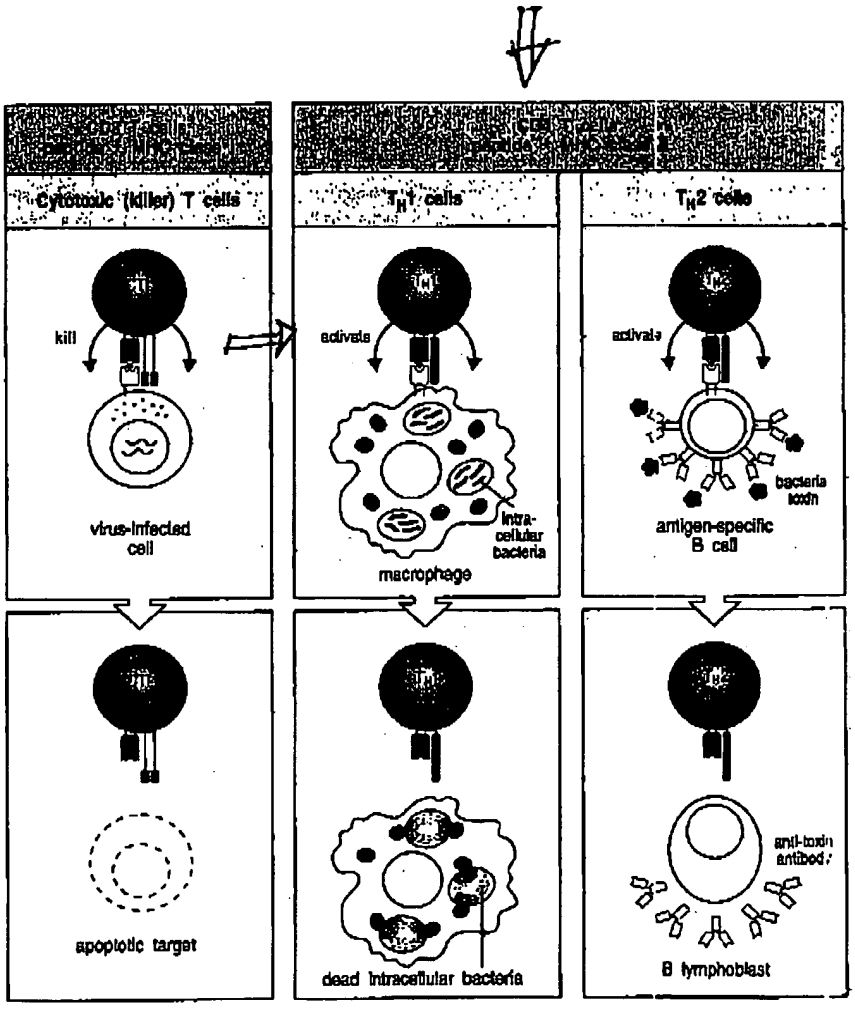


Fig. 8.26 There are three classes of effector T cell, specialized to deal with three classes of pathogen. CD8 cytotoxic cells (left panels) kill target cells that display antigenic fragments of cytosolic pathogens, most notably viruses, bound to MHC class I molecules at the cell surface. T_H1 cells (middle panels) and T_H2 cells (right panels) both express the CD4 co-receptor and recognize fragments of antigens degraded within intracellular vesicles, displayed at the cell surface by MHC class II molecules. The T_H1 cells, upon activation, activate macrophages, allowing them to destroy intracellular microorganisms more efficiently; they can also activate B cells to produce strongly opsonizing antibodies belonging to certain IgG subclasses (IgG1 and IgG3 in humans, and their homologs IgG2a and IgG2b in the mouse). T_H2 cells, on the other hand, drive B cells to differentiate and produce immunoglobulins of all other types, and are responsible for initiating B-cell responses by activating naive B cells to proliferate and secrete IgM. The various types of immunoglobulin together make up the effector molecules of the humoral immune response.